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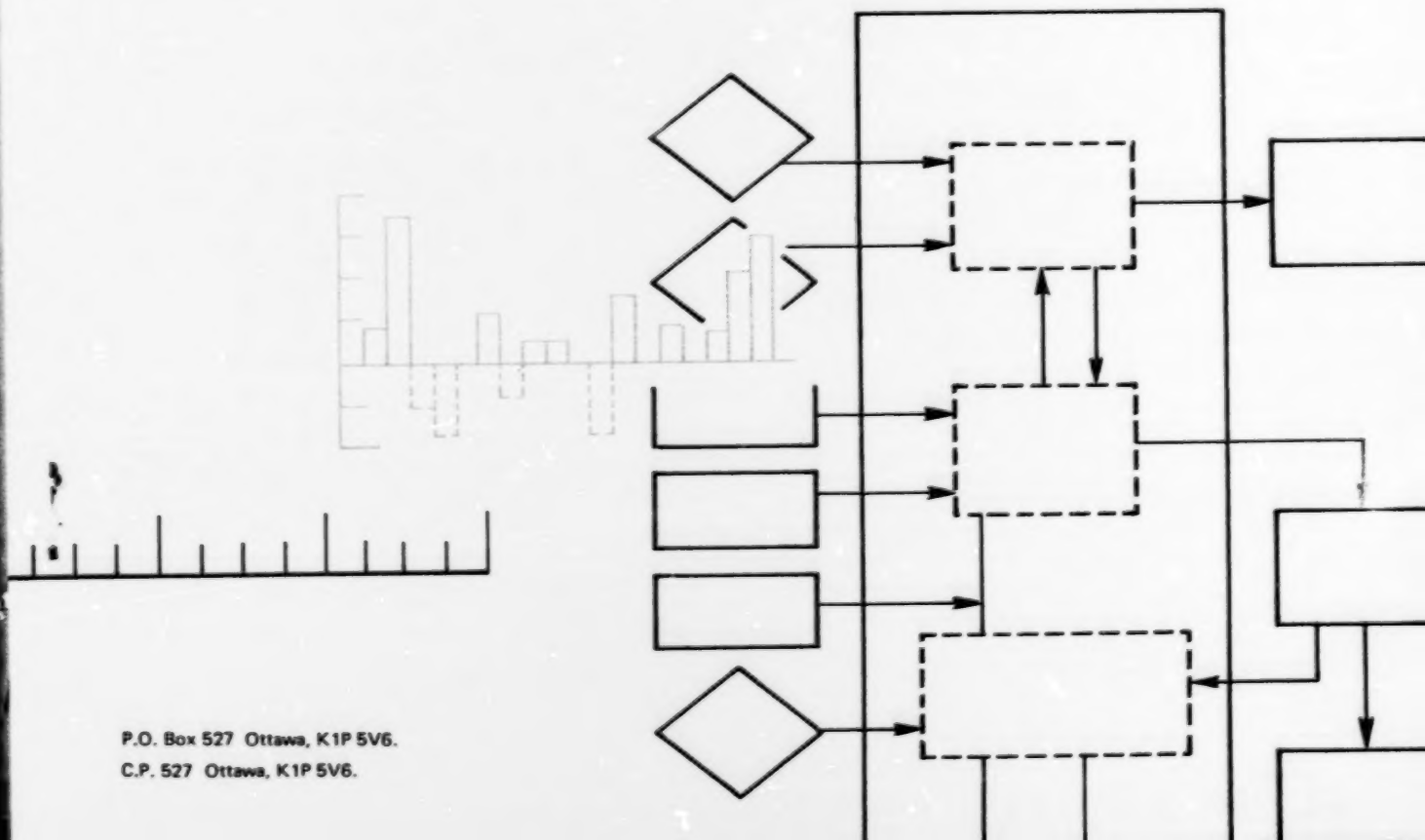

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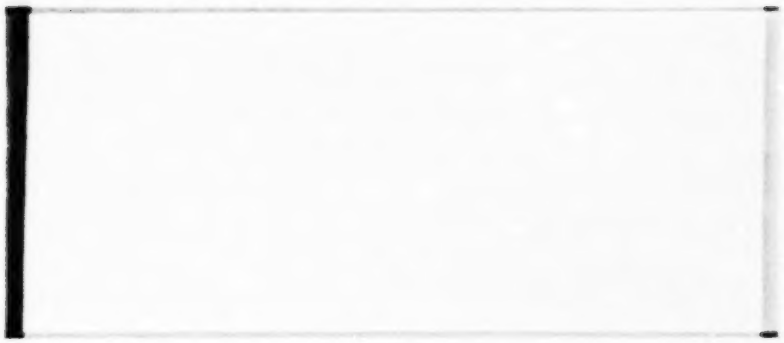

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DISCUSSION PAPER NO. 230

Economic Rents, Province-Building and Interregional Adjustment: A Two-Region General Equilibrium Analysis

by K. H. Norrie and M. B. Percy

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RÉSUMÉ

Nous examinons, dans ce document, le processus d'adaptation interrégionale à une modification des termes régionaux de l'échange, d'après diverses hypothèses au sujet de la répartition des rentes économiques. Pour ce faire, nous avons conçu un modèle stylisé de l'économie canadienne, qui comprend deux régions à plusieurs secteurs, soit celle de l'Ouest, riche en ressources énergétiques, et la région industrialisée de l'Est. Nous utilisons le modèle pour simuler l'effet d'un doublement des prix de l'énergie sur le revenu et la structure industrielle de chaque région, à partir de trois scénarios distincts de répartition des rentes économiques et d'hypothèses successives au sujet de la mobilité interrégionale de la main-d'oeuvre.

Les relations sur le plan de la production sont spécifiées de façon qu'il existe dans les deux régions des rentes économiques que les gouvernements peuvent taxer. Dans tous les secteurs des deux économies étudiées, la production s'accompagne de rendements d'échelle décroissants, d'où l'existence de rentes économiques. Évidemment, tous les résultats sont très sensibles à cette hypothèse forte, mais traditionnelle. Le secteur de l'énergie de l'Ouest produit aussi une rente élevée, surtout après le doublement des prix de l'énergie. Dans le premier scénario, le gouvernement de l'Ouest taxe les rentes des ressources énergétiques au même taux que celles des autres secteurs de

l'économie, et emploie les recettes fiscales obtenues pour financer la production des biens et services provenant du secteur public. La région de l'Est fait de même, mais elle n'a pas de rentes énergétiques à taxer. Le second scénario est semblable au premier, sauf que l'Ouest augmente sa taxe sur les rentes tirées des ressources énergétiques. Dans le dernier scénario, le gouvernement de l'Ouest utilise ses recettes fiscales pour financer la production des biens et services provenant du secteur public et assurer aux résidents un dividende fiscal qui est réparti sans aucune exigence quant à la durée du séjour.

Les résultats obtenus pour les deux régions concordent entièrement avec ceux que nous avons déjà présentés. L'amélioration des termes de l'échange de la région de l'Ouest entraîne effectivement un déplacement de travailleurs vers l'Ouest, mais les scénarios de répartition des rentes - notamment le deuxième et le troisième - accélèrent nettement la croissance, déjà considérable, de la région à en juger par l'augmentation de la population active et du revenu global. D'après les deux premiers scénarios, la production de l'Ouest devient beaucoup plus spécialisée, ce qui entraîne une contraction notable de l'industrie manufacturière secondaire et des secteurs primaires traditionnels axés sur l'exportation. Dans l'Est, d'autre part, les revenus réels diminuent, mais la structure industrielle demeure en grande partie la même. Ce n'est que dans le troisième scénario que la modification des termes de l'échange conduit à une

expansion absolue et relative du secteur manufacturier secondaire. Mais cette diversification n'est obtenue, comparativement à d'autres scénarios, qu'au prix d'une forte baisse des revenus réels par habitant dans l'Ouest.

Les résultats des simulations effectuées pour les trois scénarios indiquent nettement que la région qui applique des politiques en vue de stimuler fortement la croissance et la diversification industrielle est aussi celle qui en supporte les coûts. La principale exception tient aux facteurs fixes dans les régions en déclin dont le rendement réel se trouvera réduit à cause des politiques mises de l'avant dans les régions "en expansion". La région qui favorise des stratégies de développement global de la province est, semble-t-il, celle qui en assume presque tous les coûts, et tout particulièrement ses résidents d'avant l'essor économique. De plus, le territoire limité de l'Ouest, par rapport à l'Est, et la mobilité interrégionale de la main-d'oeuvre font que les travailleurs de l'Ouest se ressentent aussi des baisses de salaires réels qui se produisent dans l'Est par suite de la modification des termes de l'échange.

ABSTRACT

In this paper we have examined the process of interregional adjustment to a shift in the regional terms of trade under various assumptions regarding the distribution of economic rents. Our procedure was to specify a stylized model of the Canadian economy which consisted of two multi-sector regions - an energy-rich West and an industrialized East. The model was then used to simulate the impact of a doubling of energy prices on each region's income and industrial structure under three separate scenarios for the distribution of economic rents and alternate assumptions regarding the interregional mobility of labour.

The specification of the production relationships ensures that there are economic rents in both regions for governments to tax. Production in all sectors of both economies exhibits decreasing returns to scale and as a consequence economic rents exist. The energy sector of the West also generates a large amount of rent especially after the doubling of energy rents. In the first scenario the West's government taxes energy rents at the same rate as those from other sectors of the economy and uses the tax revenues to finance the provision of government sector output. The East does likewise except it has no energy rents to tax. The second scenario is similar to the first except that the West now levies a higher tax on energy rents. In the final scenario the West's government uses its tax revenues to finance the provision of government sector output and to provide a fiscal dividend for resident's which is allocated without imposing a length of residency requirement.

The results we obtain in the two region context are totally consistent with that we have offered earlier. The improvement in the West's terms of trade does lead to 'westward' shift but rent distribution scenarios such as the second and third ones visibly accelerate the extensive growth of the region as measured by labour force growth and aggregate income. Under the first two scenarios the West becomes much more specialized and there is a significant contraction of secondary manufacturing and traditional primary exporting sectors. In the East, however, real incomes decline but industrial structure is largely unchanged. Only in the third scenario does the terms of trade shift lead to an absolute and relative expansion of secondary manufacturing. But this diversification is achieved only at the expense of a significant decline in real income per capita in the West compared to other scenarios.

The simulation results for all three scenarios strongly suggest that the region initiating policies to promote extensive growth and diversification is the one which bears the attendant costs. The main exception to this is the case of immobile factors in the 'declining' regions whose real returns will be reduced by policies promoted in the 'expanding' regions. The costs of province-building strategies appear to be borne overwhelmingly within the region promoting them especially by the pre-boom residents. Moveover, the small size of the West compared to the East and interregional labour mobility ensures that real wage declines in the East brought about by the terms of trade shift are also borne by labour in the West.

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I Introduction

This is the third paper reporting the results of an ongoing research project done in conjunction with the Economic Council of Canada under the general heading of westward shift and interregional economic adjustment. The two main objectives of the research have been:

i) to ascertain the nature of economic development in Western Canada since 1971, specifically with respect to the question of whether there has been a marked change in the degree of industrial diversification either as a natural part of the development or as a result of specific government policies, and

ii) to determine the nature and extent of adjustments that have been forced on other regions as a consequence of these western developments.

The motivation for the first query is the surge of interest within the West in economic diversification possibilities. The commodity boom of the 1970's, especially that centred on energy, served to illustrate the apparent volatile nature of the present economies, and at the same time appeared to offer a possible means of moving beyond them. Thus energy was to stimulate growth directly as a growth pole, and indirectly as a source of government revenue and regulatory power. The obvious questions to raise as a research strategy are whether economic diversification was a logical outcome of the energy boom per se, what roles a variety of government

policies can play in supplementing this and at what cost, and what progress had been made as a result of either or both of these to date.

The second issue likewise stems from a real policy concern; namely, the increasing unease with which economic developments within the West during the decade were being viewed in other parts of the nation. There was a growing perception, from academics through editorial writers to politicians, that the energy boom had introduced significant new distortions into the Canadian economy. In some quarters, in fact, the argument went so far as to suggest that the evident western prosperity was (somehow) directly at the expense of the other regions. Resolution of these important issues clearly requires a better understanding of the nature of the adjustment to an interregional terms of trade change, and an application of these general insights to the Canadian case.

The first paper (Norrie and Percy, 1981) consists of an historical overview of western Canadian developments to 1971, an heuristic discussion of the process of interregional adjustment, a somewhat more substantial analysis of the nature of western economic growth in the 1970's, and some fleeting comments on the interregional adjustment issue. Very briefly, it concludes that while there are some grounds for arguing that developments in the energy sector could be the basis for at least some industrial diversification, largely due to the revenues and regulatory powers it affords the provincial

governments and in spite of some natural economic forces to the contrary, the evidence as yet records impressive extensive growth but little structural change.

The second paper (Norrie and Percy, 1982) concentrates on the first of the two issues outlined in the opening paragraph. It begins with a review of the literature on regional growth and interregional adjustment. There then follows an attempt to construct a simple, general equilibrium model of a small, open, resource-rich regional economy. This model is then loosely calibrated to resemble the Alberta economy, and used to simulate the implications of an energy price rise under a variety of alternative assumptions about how the provincial government allocates the economic rent it collects. The conclusions from these exercises are that an energy boom per se (i.e., in the absence of explicit government actions) will generate significant per capita real income gains, but will tend to reinforce the existing orientation of the economy, that government policies which distribute rents through the taxation-expenditure system can augment significantly the extensive growth of the region but at the expense of some portion of the real income gains otherwise available, and that these latter tendencies are reinforced in the event that agglomeration economies are significant.

In a related paper using much the same model (Norrie and Percy, 1983), further experimentation is done with policies which distribute rents as lump sum grants regardless

of length of residence (the pure fiscally induced migration scenario) and which provide special incentives to resource processing activities. These results demonstrate that the pure fiscal incentives case results in even more extensive growth and industrial expansion (mainly because there is less crowding out by the government sector), but at the cost of effectively dissipating the potential real income gains. Sector specific grants promote expansion of the activity targeted, as expected, but again at the expense of overall efficiency of the economy.

A model of this type is useful for the purposes described, but there are two main problems with relying on it exclusively. The first is that it ignores any feedback effects from developments in the West on other regions and on the Canadian economy more generally. Thus it cannot be used to investigate the nature of the interregional adjustment process, and hence cannot address the second of the two queries posed at the outset. The other drawback stems from the fact that the rate of change solution technique employed is not really suited to a comparative statics exercise where the exogeneous disturbances are of the magnitude of those registered by oil prices over the last decade.

The present paper is accordingly devoted to developing a two region, general equilibrium model, with interregional factor and product market links and national economic variables explicitly included. This is the topic of the following

section. The specification, it should be noted, is in a levels rather than a rate of change format, with an appropriate solution technique incorporated. The third section then uses the model to perform essentially the same policy simulations as those described above. The final section compares the results obtained in this instance with those coming from the earlier analyses and provides some brief concluding comments.

II The Model

The model is constructed generally as follows. Two separate regions are first identified, one (the West) being a relatively small, energy-rich economy and the other (the East) being a larger, more industrialized one with no energy supplies. Demand and supply functions for all commodities and factor inputs are then specified, along with a set of equations describing the behaviour of the provincial government sectors. The regions are then linked via commodity and factor flows. The final step is to introduce a foreign sector which buys and sells the outputs in the model, and supplies or absorbs savings as required, in a specified manner. The MacKinnon vector-sandwich algorithm (1975,1976) is used the calculate the vector of endogenous prices which simultaneously clears all markets. The price of oil, assumed exogenous in the model, is then arbitrarily increased and the equilibrium values recalculated. A comparison of the two outcomes allows one to discuss the

impacts of an energy boom on the two regional economies, under different assumptions about provincial government policies.

Each regional economy is composed of six separate sectors, with five of these common to both. The latter include renewable primary industries (agriculture and forestry for example), resource processing or primary manufacturing, secondary manufacturing, services and government. In addition to these the West produces petroleum, while the East produces capital equipment. The first three outputs and the last two are costlessly transportable, and interregional trade equalizes their prices. Services and government output must be utilized on site, however, so these prices can vary across regions.

The first sector consists of non-renewable industries, most importantly oil and gas. The physical output of this sector is assumed exogenously determined. Producers minimize the costs of extraction based on a cost function dual to the underlying extraction function for the sector. Extraction requires capital, labour, and intermediate inputs. The value of rents generated in the sector equals the value of output less the costs of extraction. Sector two represents renewable primary industries such as agriculture and forestry and uses intermediate input, capital, labour, and land in production. Primary output is divided into these two sectors to allow factor intensities, taxation rates and resource supply elasticities to differ. Both sectors are assumed to produce

for the entire local market and have a large surplus available for export. The primary non-renewable sector faces an exogenously set price while the renewable sector faces downward sloping demand curves. The demand condition in the regional markets is the standard one. The price sensitivity in export markets stems from a variety of considerations including: the fact that Canada does possess market power in some instances, that products are not always homogenous and thus do not always have readily available substitutes; and that transport costs can create well defined market areas. In each case a fall in western producer prices would lead to a finite increase in the quantity demanded.

Sector number three in each region consists of resource processing manufacturing industries. Outputs of sectors one and two will be important purchased inputs here, and costs for this sector will vary inversely with these output prices. Entering a resource processing sector explicitly in this manner is a way of focussing specifically on an activity upon which western industrialization hopes are riding. For those processed products for which the requisite primary input is available, the region is assumed to produce for its own needs as well as a small surplus for export. The extent of the export market will be limited by transport costs in the classical manner, however. There will be a point beyond which the mill price plus transport costs exceed that of a competing supply area, although changes in the mill price will alter the size of the market area and

thus export sales. Demand within the region will be price sensitive as well, so the overall demand curve will be downward sloping.

Sector number four in each region produces secondary manufactured goods by combining capital and labour with purchased intermediate inputs. Both regions produce manufactured goods. The country as a whole, however, is a net importer as the surplus over regional needs produced by the rest does not cover the import requirements of the West. The supply of imports from the rest of the world's upward sloping thus secondary manufactured goods are endogenous.

The fifth sector is services or non-tradeables and refers to those activities that must be produced on site. Urban housing is perhaps the best example here, with technical and personal services being another. This sector plays an important role in the model in several respects. It is absolutely very large, it is an important input to other industries as well as a final consumable good, and its relatively greater price volatility provides a key equilibrating mechanism. It is also the centre of some interesting policy issues. It figures prominently, for example, in the debate over whether resource revenue advantages in a region are capitalized into higher prices for services. Owners of land and capital in this sector also correspond to what Richards and Pratt (1977) have termed the urban industrial elite, which in their view is the prime motivating group behind Alberta's economic

diversification plans.

The sixth sector is intended to represent regional government activities. It is assumed that there is some commodity called government goods and services which public authorities provide by hiring labour and combining it with purchased inputs according to some well-defined production function. The output is best described by the term government-provided, impure public goods. Two implications that are important in what follows stem from this description. First, the fact that they are government-provided means there is no explicit per unit pricing charge for the output, as in sectors one to five; expenditures are covered out of general taxation revenues. Secondly, the fact they are not pure public goods means that as the demand by residents for the services changes, for whatever reason, the government will need to adjust the supply in the same direction. Since this sector competes with the others for available supplies of labour and intermediate inputs there is an opportunity cost to additions to public sector output. Pricing in this sector and the role it plays in the model is discussed in greater detail later in the paper.

The final sector of the model is the capital goods sector which is located only in the East. This sector combines capital and labour with intermediate inputs to produce machines. The relationship between the price of machines, the interest rate, and the rental rate of capital is discussed

in greater detail in the sections of the paper dealing with factor supplies. The sector is able to meet Eastern demands for capital goods and a portion of the West's. The country as a whole, however, is a net importer.

There is always a trade-off between analytical and computational convenience and realism, but the disaggregation given here does capture the essentials of the topic under review. Oil in the West but not in the East reflects a major economic and political fact of life. Energy price increases can be expected to affect the various manufacturing industries (and hence regions since industrial structures vary) differently, and the division between primary and secondary activities captures the most important of these. Services, by virtue of being non-traded, play an important equilibrating role in the interregional adjustment process. Changes in factor incomes in this sector also provide a useful insight into political developments in the two regions, as will be seen. Finally, the government sector will be used as the vehicle for introducing into the model the various policy measures of interest.

The first equilibrium condition to be met is that supply equals demand for each of the commodity outputs,

$$1) \quad X_i = Q_i + \sum_j a_{ij}X_j + E_i + F_i \qquad i = 1, \ldots, 7 \text{ for each region}$$

Where X_i is aggregate output, Q_i is aggregate final demand, $\Sigma a_{ij}X_j$ is the use of commodity i as an intermediate input into product j , E_i is net exports with the other region, and F_i is the

same with the rest of the world. There are 7 such equations for each region.

On the supply side, each product is produced using some or all of the three primary factors land, labour and capital in addition to purchased inputs. The production technology is Cobb-Douglas, with decreasing returns assumed to prevail.

$$2) \quad X_i = AK^{\alpha_K} L^{\alpha_L} R^{\alpha_R} \prod_j X_j^{\alpha_X} \qquad \sum_m \alpha_m < 1$$

Equation 2) can be equally represented by a cost equation of the generalized form (Varian, 1978, 16),

$$3) \quad C_i(w, r, s, P, X_i) = Bc_i(w, r, s, P) X_i^{\frac{1}{\sum \alpha_m}}$$

where w, r and s are the factor prices for labour, capital and land respectively, P is a vector of prices of purchased intermediate inputs, and B is a constant.[1] Solving for marginal cost (from 3), equating this to sector output price, and rearranging yields upward-sloping supply curves for each of the outputs in either region.

Total demand, as noted, is the sum of four separate elements. Final or consumption purchases are determined by postulating that a representative consumer maximizes a Stone-Geary utility function containing private goods and the perceived share of public sector output,

$$4) \quad U = \sum \beta_i \log(q_i - \theta_i) \qquad i = 2, \ldots, 6$$

subject to an income constraint,

$$5) \quad \sum_{i=3}^{5} P_i q_i + t_L = y_d$$

In these equations q_i is the per capita consumption of output i, t_L is the per capita levy imposed by the regional government, and y_d is the income available for consumption. This maximization yields a linear expenditure system of demand equations of the following form when aggregated over all consumers,

$$6) \quad Q_i = \theta_i + \beta_i \frac{Y_d - \Sigma P_i q_i}{P_i}$$

The parameters θ_i and β_i can now be interpreted as the subsistence consumption and the marginal budget share of i respectively. Y_d is the sum of labour earnings plus the net of taxes returns to capital and land, minus the amount allocated to personal savings (S_p),

$$7) \quad Y_d = w \cdot L + \sum_i (1 - t_{Ki}) r_i k_i + \sum_i (1 - t_{Ri}) s_i R_i - S_p$$

t_{Ki} and t_{Ri} are the ad valorem taxation rates on capital and land respectively in sector i.

One of the terms included in equation 4) is q_6, the representative individual's perceived share of public sector output. This becomes transformed via the utility maximization process into an individual demand function for government output, and is then aggregated to get Q_6. The implication of this formulation is that consumers treat public sector output as one of a number of competing uses for their given

incomes, and arrange their purchases such that the standard optimality conditions are met. In other words, the assertion is that the individual (and hence aggregate) demand for government output is a well-defined function of income and its price relative to those for private products. Since the notion that residents will alter their demand for government services in response to a change in perceived relative price is a key element in what follows, it is worth discussing further.

The specification of the demand for government output adopted here follows that now common in public choice literature (Borcherding and Deacon (1972), Bergstrom and Goodman (1973), Denzan and Mackay (1976), Gramlich and Rubinfeld (1982)). It is assumed for simplicity that each resident perceives himself as obtaining an equal share of total government output,

$$8) \quad q_6 = \frac{X_6}{L}$$

The individual is not charged on a per unit basis for the output as in the private market, however, but rather faces a per capita levy, t_L, set as a residual to exactly balance the government's budget,

$$9) \quad \sum_i t_{Ki} r_i k_i + \sum t_{Ri} s_i R_i + t_L L = C_6 X_6 + H$$

C_6 is the average cost of providing public sector output, so $C_6 X_6$ is total government expenditure. H is the allocation by the authorities of a portion (h) of non-renewable resource

revenue to a Heritage Savings Trust Fund,

$$10) \quad H = ht_{R1}s_1R_1 \qquad 0 \leq h \leq 1$$

This latter feature is intended to represent the Heritage Savings Trust Funds of Alberta and Saskatchewan. These funds have, of course, generated considerable policy discussion, so it is useful to incorporate them explicitly into the model. If the apparent price of public sector output to the individual resident is defined as,

$$11) \quad P_6 = t_L/q_6$$

the consumer maximization process yields demand equations of the following form given in equation 6).

This formulation can be described even more generally as follows. The government purchases labour services and intermediate inputs at prevailing market prices, and is constrained in producing its output by a Cobb-Douglas production technology exhibiting decreasing returns. The demand for government services is determined along with those for all other final consumption goods by residents maximizing a given utility function subject to an income constraint. The government will provide the level of output demanded, but must operate with a balanced budget. It is this latter requirement which determines the size of the per capita levy on labour, which in turn defines the perceived marginal tax price of public sector output, and thus which makes the demand system theoretically

consistent.

Each regional government derives revenue from taxing incomes accruing to land, capital and labour. The taxation rates on the first two are set exogenously. A portion of the revenue obtained from non-renewable resource production is automatically put into Heritage Fund, and treated henceforth as public sector savings. The remainder is used along with the other revenue to cover the outlays incurred in the course of production such that the budget exactly balances. The tax on each unit of labour thus becomes an endogenous variable, equal to the sum of government expenses minus revenue collected from capital and land, divided by the number of units of labour. This levy, divided by the perceived share of public sector output, is the price that consumers are conscious of paying for the services they receive, and is the one that enters the demand system.

It is clear from equations 8) - 11) that $P_6 = C_6$ whenever $t_{Ri} = t_{Ki} = 0$. That is, in the absence of government revenue from taxation of capital and natural resources the levy on residents for a unit of public sector output is equal to the average social cost to the government of providing it. Conversely, whenever these revenues are greater than zero, the charge to workers for public sector services will be less than the actual expenses the government incurs in providing them. Public sector output will be relatively inexpensive, and residents will consume more of this and less private

goods than they would in a non-distorted world. There will be an efficiency loss in this instance since the social evaluation of the final units of public sector output will be less than the social costs of providing them.

The demand for X_i as an intermediate input can be derived directly from either the production or the cost function, since a_{ij} is the cost minimizing input of i per unit of output of j. Any output of i in one region in excess of these two demands will go first to the other region (E_i), as long as there is an excess demand there, and then onto the world market. Any shortfall in production will come from the other region as far as possible, and then from foreign suppliers. The external supply or demand is given by

$$12) \quad F_i = \rho \left[\frac{p_i}{e}\right]^{\sigma_i} \qquad \begin{matrix} \rho_i > 0 \\ \sigma_i < 0 \end{matrix} \quad i = 2,3 \qquad \begin{matrix} \rho_i > 0 \\ \sigma_i < 0 \end{matrix} \quad i = 4,7$$

where the intercept ρ is positive for net exports and negative for imports, with the opposite being true for the sign of the elasticity parameter σ, e is the exchange rate, given as the number of Canadian dollars per unit of foreign exchange. Equation 12) thus expresses foreign demand or supply curves in terms of their own currency.

The next set of conditions to be met is that the supplies of the three primary factors equal the demands for them. The latter can be calculated from the production or cost functions in the same manner as the intermediate product demands. It should be noted though that the demand in each sector is for

the services of these inputs rather than for the stocks. The supply of land is responsive to the after tax real rental rate,

$$13) \quad R_i = R_o[s_i(1 - t_{Ri})/PPI]^{\gamma_{Ri}}$$

s_i is the rental rate per unit of land, t_{Ri} the taxation rate, PPI, the producer price index and γ_{Ri} the supply elasticity. In practice, γ_{Ri} will likely be quite small relative to that for labour and capital.

Capital is produced in the East according to a well defined supply function in the same manner as are the final outputs. The relevant supply price is that for machines, however, which is different from the rental charge on capital used in the cost equations above. In long run equilibrium the rental charge can be capitalized by the sum of the interest plus depreciation rate to yield the machine price. With this latter value set equal to marginal cost, the supply curve of capital goods from the East can be derived from the Cobb-Douglas production technology in the standard way. Capital is also available externally by the relevant supply equation in equation 12). In equilibrium the demand for capital is equal to the depreciation of the existing capital stock.

There are a variety of assumptions possible for the interregional allocation of labour. In one set of simulations reported below labour supply in each region is held constant. Any shift of production among sectors must then come from an internal reallocation of labour services. In another, labour is assumed to be perfectly responsive to interregional real wage

is assumed to be perfectly responsive to interregional real wage differentials. Migrants will continue to flow from low to higher real wage jurisdictions until real wages are equalized. The regional supply of labour is given by 14),

$$14) \quad L = L(W_r/CLI_r - W_s/CLI_s)$$

where W is the nominal wage in the sending (s) and receiving (r) regions, and CLI is the corresponding cost of living index. This latter variable is a weighted sum of the prices of the five consumption goods, including the apparent marginal tax price of government output.

$$15) \quad CLI = \sum_i \gamma_i P_i \qquad i = 2, \ldots, 6$$

where γ_i is the quantity of commodity i in the representative consumption basket. It is useful in the discussion below to define an alternative cost of living index, $\hat{CLI}$, in which C_6, the true social cost of public sector output replaces P_6, the apparent tax price.

Investment in each region is equal to the value of the demand for capital goods. As noted above, private savings are defined to equal a constant portion of wage income and after-tax capital and labour returns. This, summed across regions and together with any Heritage Fund balances, is the total amount of saving generated domestically. In equilibrium, savings must cover depreciation of the existing capital stock.

Any surplus of savings over investment requirements is lent abroad at the exogenously given interest rate, while any short-fall is financed at this same rate.

The final specification required is that for the foreign trade sector. The rest of the world is the residual buyer or seller of products which remain in excess supply or demand once interregional trade is completed, as well as the passive creditor or debtor on the capital account. The total Canadian payments accounts must balance in equilibrium. The exchange rate adjusts so that the Canadian dollar value of foreign exchange receipts on both the merchandise and capital account exactly equals the Canadian dollar value of disbursements. Thus the exchange rate does not affect any real variables in the model.[2]

The fact that total Canadian trade is balanced does not mean that each region's is as well, of course, which raises the troublesome question of how to deal with a regional balance of payments surplus or deficit. There is clearly no need to require the accounts to balance in the short run. The very essence of a common currency federation is that financial assets and/or government transfer payments can be reallocated interregionally virtually costlessly. Scitovsky (1969) discusses this process in general, and Norrie and Percy (1981) apply it to the Canadian setting. In the longer run, however, the interregional adjustment literature suggests there will be a tendency for the accounts to move into bal-

ance when not offset by accomodating government transfers. This comes about by some combination of price, income and factor migration effects. Payments deficits are accompanied by falling prices, incomes and factor supplies, all of which tend to reduce imports and expand export sales. For a regional surplus the reverse is true. Norrie and Percy (1981) used this last case in fact to illustrate how the increased value of petroleum exports to easter Canada would eventually be matched by a larger real flow of goods and services to the West.

Income and factor migration and some relative price effects are already part of the model. To see this, consider the impacts of an exogenous increase in the value of energy exports starting from a position of payments balance for the West. As incomes rise the demand for imports of manufactured goods increases along with all other products. As domestic prices rise in response to the increased demand, there is a tendency to substitute away from these and to manufactured imports to the extent the cross-partials are different from zero, further reducing imports. Finally, any induced labour migration that results will also increase the flow of manufactured products to the region.

There is no guarantee that these mechanisms alone will bring the accounts into balance. For this to happen, there must be an explicit link to the interregional shift of financial assets that must accompany any ongoing internal disqui-

librium. The problem in a modelling sense is that this is inherently a dynamic problem while the present model is a comparative static one. Thus we leave this particular issue to future research. An earlier paper (Norrie and Percy, 1982) demonstrated that a one region model was not sensitive to this constraint, so neglecting it here may not be too serious either.

III. Simulation Results

The object of this section is to illustrate the manner in which the model can be used to evaluate alternative rent disposition policies. It begins with a base case simulation. All land and capital is privately owned, and income deriving from these is subject to taxation by the respective regional governments at a common rate. The governments allocate whatever returns they raise in this manner into general revenue, and then levy a per capita charge on each resident sufficient to balance the overall budget. The model is then solved for that vector of endogenous variables that simultaneously clears all markets, including the equilibrium interregional allocation of labour. These values are then set equal to 100.0, and are used as a basis of comparison for all subsequent simulations.

Two points about this case should be noted at the outset. First, unlike the base case simulation reported with the one region model (Norrie and Percy, 1982, 1983) this one does not represent the most efficient allocation of resources in either economy. Economic rents and profits exist even before the energy price increase, and governments are using them to "top up" general revenues. The post-oil-price-shock economies are thus to be com-

pared to ones that are already distorted, rather than some theoretical ideal. The other observation is apparent in the use of the plural form in this paragraph. Prior distortions exist in both regional economies, not simply in the West. This reflects the findings of Copithorne (1979) that the Central Canadian economy generates substantial economic rents from its industrial base. Both features represent improvements over the one region analysis in the ability to represent actual Canadian policy issues.

With this base case specified, three separate sets of simulations are carried out. In the first, reported in Tables 1 and 2, the world price of oil denominated in foreign currency is doubled, but no taxation or expenditure charges are made. This exercise focuses on the impact of a shift in the interregional terms of trade, and illustrates generally what would have occurred in the absence of any new government policy initiatives. Tables 3 and 4 then give the results of an identical oil price shock under the assumption that the host regional government moves to capture a larger share of the resultant economic rent, but still allocates it entirely to general revenues. This is, of course, precisely what the western provinces did after 1973, so there results are of considerable interest. The final two tables illustrate the implications of a policy whereby the public sector revenues are allocated on an equal per capita basis to all residents, irrespective of when they arrived in the province. This is the purest case of fiscally induced migration, and is of interest because of the great amount of attention it has received in the theoretical literature.

Two separate simulations are provided for each of these rent disposition schemes. In one, the supplies of land and capital are allowed to adjust in accordance with the supply function given above, but the regional labour forces are held constant. In the second interregional migration proceeds until

real wages are equalized as well. Partitioning the results in this manner highlights the role played by this most politically sensitive component of the interregional adjustment process. It is also interesting in a normative sense since invoking the first assumption is tantamount to enquiring into the economic well-being of those that were resident in the respective regions prior to the terms of trade shift. Once populations are allowed to adjust, the notion of a regional social welfare function becomes even more ambigious.

The model is not as yet calibrated exactly to specific provinces. Rather, it represents two stylized regional economies that broadly resemble the energy-rich West and the industrial East. The West is the sole energy producer and the East the only domestic source of capital goods, but the other five sectors are found in both regions. The domestic oil price is fixed by government fiat. The excess supply in the West at that price is transported costlessly to the East to make up a portion of its needs. The remainder (i.e., Canada is a net importer of oil), is purchased from abroad at the given world price. Both regions export renewable resource and primary manufactured output in excess of local requirements according to an assumed highly elastic demand curve. The West uses whatever excess supply of secondary manufactured goods and capital equipment that exists in the East at the current domestic price, and imports the rest. As in the case of oil, this interregional trade ensures there is but one domestic price. Services and government are non-tradeable by definition, so prices and outputs for these are set independently by regional supply and demand.

The national economy is running a deficit on current account and has a surplus on capital account. The exchange rate is flexible and assumes a value which ensures that receipts of Canadian dollars equals disbursements of them. Any regional payments imbalances, however, are assumed to be offset

by a willingness to hold indefinitely the financial assets of deficit regions. Land is an input into the renewable resource and service sectors and has an elasticity of supply with respect to the real rental rate of 2.0. Labour is used as an input in all sectors and is allocated across sectors within a region until real wages are equalized. The participation rate of the labour force does not vary, hence an increase in labour services within a region can only be obtained through interregional migration. Additional information on the initial or pre-shock structure of the economies is given in the first two columns of Table 2 below.

Table 1 presents the response of the regional economies to a doubling of foreign oil prices to 15.00 units of foreign currency under the assumption that there is no change in the structure of taxation on government expenditures. Interregional labour migration is absent in columns 1 and 2, but present in 3 and 4. As indicated above, the solutions are indexed relative to a base of 100.0 for the relevant row entry in the pre-shock case. Thus the numbers in any particular row can only be compared across scenarios for the same region, except of course in the cases of prices of traded commodities and real wages. Table 2 provides additional information, in percentage terms, on the government sector and the distribution of the labour force across industries.

The basic features of an interregional terms of trade shift are illustrated in the tables. Real output declines in the East in all sectors except renewable resources where a modest increase takes place. Rising oil prices have increased costs and hence output prices for eastern industries, causing them to lose sales absolutely to an extent depending directly on the elasticity of export demand. This reduction in output creates excess supply in factor markets, putting downward pressure on those prices. Capital is perfectly mobile with respect to changes in these returns so the supply operating in the region is

GLOSSARY

Tables 1, 2, 3, 4, 5, 6

The simulation results of Tables 1, 3, and 5 are expressed in terms of a comparison to the initial position of each region in the base case prior to the energy price shock. That is, the value of each variable in the initial position for each region equals 100.0. Tables 2, 4, and 6 provide data on the distribution of labour force and proportion of government expenditures covered by the per capita levy imposed on consumers. There are three scenarios.

Scenario I: This case assumes that energy rents are taxed at 50%, the same rate as economic profits in other sectors. The energy revenues captured by the government are distributed as follows: 70% for financing the provision of government output and 30% for public savings.

Scenario II: Identical to Scenario I except that the government of the West now collects 75% of the energy rents instead of 50%. The rents captured by the government are distributed between the provision of government output and savings in the same proportions as before.

Scenario III: The government of the West now collects 64% of the energy rents and distributes them in the following fashion. 50 percentage points of the rents are distributed between financing the provision of government output and public savings in the same proportions as before. The additional 14 percentage points of the economy rents are distributed to residents of the West in the form of a fiscal dividend with no length of residency requirement imposed.

Each scenario involves three separate simulations. The first is the equilibrium level of the variables prior to the energy price shock but including the distributional mechanisms for distributing energy revenues. The initial position of Scenario I represents the base against which all subsequent simulations in Tables 1, 3, and 5 are compared. The second simulation of each scenario incorporates an energy price shock - the doubling of oil prices - but does not allow for a reallocation of labour between the East and the West. The final simulation of each scenario allows for interregional labour flows in response to real income differentials.

Variable Definitions

X_1 Production of non-renewable resources (oil) sector

X_2 Production of renewable resources sector

X_3 Production of primary manufacturing sector

X_4 Production of secondary manufacturing sector

X_5 Production of services (non-traded goods sector)

X_6 Production of publicly provided private goods (government sector)

X_7 Production of capital goods

P_1 Price of oil (exogenously set)

P_2 Price of renewable resources

P_3 Price of primary manufacturing

P_4 Price of secondary manufacturing

P_5 Price of services

P_6 Consumer price of government sector output

P_7 Price of machines

C_6 The social cost of a unit of government output

CLI Cost of living index inclusive of P_6

$\hat{CLI}$ Cost of living index inclusive of C_6

w Nominal wages

s Nominal rent of land in renewable and service sectors

(Y/CLI)(1/L) Real income per capital evaluated at distorted prices

$(Y/\hat{CLI})(1/L)$ Real income per capita evaluated at undistorted prices

λ_i Share of labour force employed in i^{th} sector

TABLE 1

REGIONAL INCOMES AND INDUSTRIAL STRUCTURE UNDER ALTERNATIVE MECHANISMS FOR DISTRIBUTING ENERGY RENTS

	Price of Oil Doubles,		Price of Oil Doubles,	
	East (1)	West (2)	East (3)	West (4)
X_1		100.0		100.0
X_2	100.2	93.1	98.7	94.4
X_3	92.4	87.9	91.1	89.9
X_4	97.7	90.9	97.1	95.1
X_5	98.4	100.8	97.5	102.6
X_6	98.5	118.1	97.7	119.8
X_7	95.9	-	95.5	-
P_1	154.8	154.8	155.1	155.1
P_2	102.5	102.5	102.5	102.5
P_3	109.7	109.7	109.8	109.8
P_4	102.4	102.4	102.6	102.6
P_5	101.7	102.9	101.8	102.8
P_6	101.7	87.5	102.0	87.5
P_7	102.2	102.2	102.4	102.4
CLI	103.1	103.6	103.1	103.6
$\hat{CLI}$	103.0	103.6	103.0	103.6
w	100.0	102.1	100.0	100.9
s	100.9	100.8	100.0	101.5
real wage	97.3	98.6	97.3	97.3
$(Y/CLI)\ (1/_L)$	97.1	105.2	97.1	103.6
$(y/\hat{CLI})\ (1/_L)$	97.8	105.2	97.2	103.6
exchange rate	77.4		77.5	
National real y	99.6		99.5	

Source: see text.

TABLE 2

STRUCTURES OF THE EASTERN AND WESTERN ECONOMIES UNDER ALTERNATIVE MECHANISMS FOR DISTRIBUTING ENERGY RENTS

	Initial Position		Price of Oil Doubles:		Price of Oil Doubles:	
	East (1)	West (2)	East (3)	West (4)	East (5)	West (6)
% of govt. exp. financed by T_L	8.78	4.86	8.78	4.09	8.79	4.11
Distribution of labour force across sectors						
λ_1	-	.2	-	.2	-	.2
λ_2	5.4	22.0	5.6	20.6	5.5	20.5
λ_3	8.8	13.9	8.9	13.2	8.8	13.2
λ_4	27.4	7.5	27.3	6.8	27.4	7.0
λ_5	42.7	46.1	42.7	46.9	42.7	46.9
λ_6	5.8	10.3	5.8	12.3	5.8	12.2
λ_7	9.9	-	9.7	-	9.8	-
Share of population	74.8	25.2	74.8	25.2	74.1	25.9

Source: see text.

reduced accordingly. The initial decline in rental rates on land also results in a movement down along its supply curve. Now land and labour are relatively inexpensive compared to the costs of purchased intermediate inputs, so there is a substitution towards more land and labour intensive production in all sectors. The net result is that nominal wages and rents are virtually unchanged, although their real value has fallen considerably. Overall aggregate real incomes in the East are only 97.3% of what they were prior to the price shock.

The pattern is broadly similar in the West, but with two important exceptions. Rising oil prices also push up input costs in this region, resulting in a loss of some export markets and the consequent decline in factor demands. The differences come first from the fact that western governments appropriate a significant portion of the economic rent generated, even without revising royalty rates, and this is channeled via price effects (P_6) into additional public sector output. The share of government expenditure financed by direct taxation is halved, as seen in Table 2. In addition, private real income in the West is up due to the resource boom, and this results in an increased demand for the output of the non-traded service sector. Nominal wages rise slightly as a consequence, although less than the cost of living index. Overall, however, real incomes in the West are 5.2% higher, in contrast to the decline in the standard of living in the East.

There is surprisingly(at least to some) little restructuring of the two regional economies following the oil price shock. The industrial mix in the East is virtually unchanged. Services and government employment in the West expand at the expense of the renewable resource and primary and secondary manufacturing sectors. Clearly, the energy boom <u>per se</u> will not mean

industrial diversification for the western provinces. This is an important conclusion in that it explains both the tendency of these governments to want to intervene in the industrialization process, and the countervailing market forces they face in doing so.

The increase in the size of the public sector in the West, brought about by the larger wedge between the marginal tax or demand price and the social opportunity cost or supply price of the output, is the distortion which helps explain the slight decline in national real income. Otherwise, the loss in real income in the East is offset by the gain in the West, once weighted by population shares. The constant output of oil, in the face of declining demand for it in the East, means that Canada switches from being a net importer to a net exporter of this product. This change, together with the decline in the demand for imported consumer and capital goods, accounts for the appreciation of the exchange rate.

These results do not allow for any interregional reallocations of labour. Real wages have fallen more in the East than in the West though, so there will be a net movement of workers westward. The final two columns of Tables 1 and 2 show the results of allowing for this equilibrating mechanism. As it happens, a transfer of 0.7 percentage points is sufficient to reequate real wages. The outmigration from the East means a further decline in output in all sectors relative to the base case, while in the West there is a concomitant greater expansion (or lesser decline) everywhere. Industrial structures are virtually unchanged (Table 2), as migrants are distributed broadly across all sectors.

Two features of the final columns in Table 1 deserve further comment. First, it will be noted that real wages in the West have declined to the

eastern level. The outflow was not a large enough portion of the total to raise the level in the latter region, but it did bring down returns in the smaller, western labour market. The tendency of the energy boom to favour disproportionately landowners rather than workers that was evident in columns 1 and 2 is further exacerbated once internal migration is allowed to proceed. Secondly, there is a further very small decline in national real income. Apparently the additional distortion due to the further expansion of the government sector (119.8 instead of 118.1) more than offsets efficiency gains due to a more proper interregional allocation of labour.

The results thus far have assumed no change in government taxation or expenditure. Provincial governments did react to the energy crisis by raising royalty rates on existing and new reserves. Tables 3 and 4 accordingly simulate a situation where the taxation rate on energy rents is 75% instead of the 50% assumed earlier, and where all extra revenues raised are put into the Heritage Fund (30%) or general revenues (70%) as before. The first two columns of each table represent the values before the price increase, while the final four correspond to the post-shock situation.

The first thing to note from Table 4 is that the West has a slightly higher share of the nation's population, 25.7% instead of 25.2%, even prior to the terms of trade shift. This results because the extra resource revenue has driven down the apparent tax price of public sector output even further, resulting in an even greater expansion in the quantity demanded, and thus requiring extra labour inputs. Some of this has come at the expense of the traded sectors, whose outputs are slightly lower relatively speaking due to marginally higher prices. The rest results from the model reallocating labour from the East to the West until real wages are equalized.

The changes in the two other national variables are worthy of note.

TABLE 3

REGIONAL INCOMES AND INDUSTRIAL STRUCTURE UNDER ALTERNATIVE MECHANISMS FOR DISTRIBUTING ENERGY RENTS: ALLOCATION THROUGH THE PROVISION OF GOVERNMENT SECTOR OUTPUT

	Initial Position		Price of Oil Doubles,		Price of Oil Doubles,	
	East (1)	West (2)	East (3)	West (4)	East (5)	West (6)
X_1	-	100.0	-	100.0	-	100.0
X_2	97.4	99.4	99.8	91.7	97.4	93.0
X_3	99.1	99.6	91.8	86.8	90.0	89.6
X_4	99.3	99.4	97.0	89.3	95.9	94.7
X_5	99.4	100.4	97.9	100.6	96.5	103.0
X_6	99.3	120.0	97.9	148.2	96.5	150.7
X_7	99.4	-	95.5	-	94.7	-
P_1	101.2	101.2	157.2	157.2	157.4	157.4
P_2	100.0	100.0	102.5	102.5	102.5	102.5
P_3	100.2	100.2	110.1	110.1	110.2	110.2
P_4	100.1	100.1	102.6	102.6	102.8	102.8
P_5	100.0	100.1	101.8	103.2	101.9	103.1
P_6	100.0	79.2	102.2	62.5	102.2	66.7
P_7	100.1	100.1	102.4	102.4	102.7	102.7
CLI	100.0	100.0	103.2	103.4	103.3	103.9
$\hat{CLI}$	100.0	100.0	103.1	103.4	103.2	103.9
w	100.0	100.0	100.0	102.6	100.4	101.3
s	99.6	100.0	100.4	100.0	99.3	101.6
real wage	100.0	100.0	97.1	98.8	97.3	97.3
$(y/CLI)(1/_L)$	100.0	99.0	97.2	103.4	97.4	101.9
$(y/\hat{CLI})(1/_L)$	100.0	99.0	97.3	103.4	97.5	101.9
exchange rate	101.1		78.5		78.7	
National real y	99.8		99.3		99.2	

TABLE 4

STRUCTURE OF THE EASTERN AND WESTERN ECONOMIES UNDER ALTERNATIVE MECHANISMS FOR DISTRIBUTING ENERGY RENTS: ALLOCATION THROUGH THE PROVISION OF GOVERNMENT SECTOR OUTPUT

	New Initial Position		Price of Oil Doubles		Price of Oil Doubles	
	East (1)	West (2)	East (3)	West (4)	East (5)	West (6)
% of govt. exp. financed by T_L	8.80	3.87	8.78	3.07	8.83	3.09
Distribution of labour force across sectors						
λ_1	-	.2	-	.2	-	.2
λ_2	5.4	21.5	5.6	19.8	5.5	19.6
λ_3	8.7	13.6	8.9	12.7	8.8	12.8
λ_4	27.4	7.3	27.3	6.6	27.4	6.8
λ_5	42.7	45.4	42.7	45.7	42.6	45.7
λ_6	5.8	12.2	5.9	15.1	5.8	14.9
λ_7	10.0	-	9.8	-	9.8	-
Share of population	74.3	25.7	74.3	25.7	73.3	26.7

Canadian real income is marginally lower in this case, due entirely to its lower value in the West, which in turn results from the greater distortion due to public sector expansion. The exchange rate is depreciated somewhat relative to the base case, largely because the increase in Heritage Fund savings has reduced the need for foreign capital.

Columns 3 and 4 of Tables 3 and 4 show the results of a doubling of the foreign price of oil under this new tax regime. The structural impacts are similar to those reported in Tables 1 and 2, only now they are more accentuated. Public sector output in the West expands more, due to the lower marginal tax price, and its share of the total labour force rises to 15.1%. There is more crowding out of the traded sectors than previously, and even the service industry is marginally smaller than in the equivalent row entry in Table 1. Output in the East is lower in all sectors compared to the base case, but this is largely due to the smaller labour force in the region even prior to the oil price increase.

Nominal wages rise slightly more in this instance, due to the greater expansion of the labour intensive government sector. The cost of living index is fractionally above that in the first simulation, but not by enough to totally offset the nominal wage gain. Other factors lose more as a result of the policy change, however, as evidenced by the fact that the increase in real incomes in the West is about 1.5 percentage points less in this instance. This reflects the extra revenue now deflected to the government and used to subsidize the provision of this one particular type of output. The exchange rate appreciates less as the increase in Heritage Fund savings replaces some foreign capital inflows.

The final two columns show the results of allowing the labour market to

adjust interregionally. The West's share of Canadian population rises by 1 percentage point from the initial position, and is 1.5 points above what it was in the base case. There are two separate determinants of this labour migration. The relatively greater expansion of the non-traded sectors in the West has created some excess demand for the labour market, pushing up nominal wages. In addition, the subsidy given to public sector output reduces the apparent price of this component of the consumption basket, holding the cost of living index down below what it otherwise would be. Migration in response to this latter phenomenon could be termed fiscally induced, while the former is more the traditional labour market disequilibrium variety.

This labour migration causes an across-the-board fall in output in the East, and a similar rise in the West. Interestingly, the government sector is now fully 50% larger than in the base case. Equally noteworthy is the fact that both manufacturing sectors have declined absolutely under these same circumstances, as has the renewable resource sector. The energy price increase in and of itself acts to increase the specialization of the western economy in energy and services, and this particular policy appears to exacerbate this tendency. Even the other traditional bases of the region's economy such as agriculture and forestry are adversely affected by the crowding out occurring.

The income distributional implications of this scenario are noteworthy. Real per capita income in the West falls in the final column in comparison to that in column 4, while that in the East rises slightly. This results from migration acting to equalize real wages and spreading western resource revenues over a larger population base. Equally interesting is the fact that western real incomes after migration are lower now than they were in Table 1. The additional distortions imposed upon the economy, and the greater number of migrants attracted by the policy, have acted to dissipate a substantial

portion of the potential real income gain inherent in a terms of trade shift. As in the one-region models discussed above then, the costs of province-building efforts in the West appear to be borne internally, rather than being shifted onto other jurisdictions (at least from the viewpoint of the residents in the West prior to the boom). National incomes are even somewhat lower, as losses in the West do not fully compensate for gains in the East.

There is fiscally induced migration in these simulations, but it comes about only indirectly via a reduction in the apparent marginal tax price of government output. Given the prominence this concept has played in the theoretical literature, it is useful to try to allow for this phenomenon more directly. Tables 5 and 6 accordingly are based on the following policy scenario. The western government captures 64% of the energy rents. 50 percentage points of these are put into general revenues or the Heritage Fund, with the split here being 70% and 30%, respectively as above. The remaining 14 percentage points are distributed in a lump sum fashion to all westerners, irrespective of the length of residency. This fiscal dividend is now a part of the potential real income gain available from migrating to the West, so enters the interregional labour migration function directly. Only the final two columns are given in Tables 5 and 6, since the initial position and the no-migration case are identical to the first four columns of Tables 1 and 2.[3]

The results of this simulation differ markedly from the earlier ones. The West's share of the population in equilibrium is now 29.1%, as opposed to 25.2% in the base case. What this reflects of course is the rightward shift of the labour supply curve in the West; for any given real wage, there is a greater migration seeking the fiscal dividend. This shift lowers nominal and real wages in the West and raises them in the East. Relative operating

TABLE 5

REGIONAL INCOMES AND INDUSTRIAL STRUCTURE UNDER ALTERNATIVE MECHANISMS FOR DISTRIBUTING ENERGY RENTS: ALLOCATION THROUGH DISTRIBUTION OF SOCIAL DIVIDEND WITH NO RESIDENCY REQUIREMENT

	Price of Oil Doubles,	
	East (1)	West (2)
X_1	-	100.0
X_2	92.1	98.2
X_3	85.4	98.3
X_4	93.7	113.0
X_5	93.9	110.0
X_6	93.5	127.0
X_7	93.5	-
P_1	155.9	155.9
P_2	102.3	102.3
P_3	110.1	110.1
P_4	103.6	103.6
P_5	102.3	102.5
P_6	103.3	86.9
P_7	103.6	103.6
$\hat{CLI}$	103.7	103.8
CLI	103.6	103.7
w	101.2	96.4
s	97.0	106.0
real wage	97.8	92.6
$(y/\hat{CLI})(1/_L)$	97.8	97.1
$(y/CLI)(1/_L)$	97.9	97.0
exchange rate	78.0	
National real y	97.2	

TABLE 6

STRUCTURE OF THE EASTERN AND WESTERN ECONOMIES UNDER ALTERNATIVE MECHANISMS FOR DISTRIBUTING ENERGY RENTS: ALLOCATION THROUGH DISTRIBUTION OF SOCIAL DIVIDEND WITH NO RESIDENCY REQUIREMENT

	Price of Oil Doubles,	
	East (3)	West (4)
% of govt. exp. financed by T_L	8.83	4.25
Distribution of labour force across sectors		
λ_1	-	.2
λ_2	5.3	19.9
λ_3	8.6	13.6
λ_4	27.6	7.9
λ_5	42.6	46.7
λ_6	5.8	11.9
λ_7	10.0	-
Share of population	70.9	29.1

costs adjust accordingly, and thus sectoral outputs. For the first time there is an absolute expansion of secondary manufacturing in the West, for example. The service sector is also substantially larger than in either previous scenario as well. Even the other two traded sectors contract much less, as crowding out is no longer as serious a constraint on them. To the extent that economic diversification is taken to mean an expansion of manufacturing and service industries then, this is the first indication that such an outcome is possible under appropriate policy measures.

This diversification does not come cheaply, however, which is perhaps the most instructive result of this simulation. Real per capita incomes in the West are actually lower in this event than in the base case. That is, long-time residents of the region are on an average actually worse off now than they were before oil prices increased. Four factors account for this. One, as before the increased distortions in the economy due to the relative expansion of the public sector have reduced the potential real income gain. Two, the cost of living has increased, reducing the value of any given nominal income. Three, nominal wages have been pushed down by rent-seeking migrants. Finally, existing resource revenue is now spread over a larger population, reducing the per capita share.

These results seem to indicate that the costs of province-building efforts by a small, regional economy are largely borne internally. This conclusion is verified by glancing at the values of the eastern economy. Real wages and aggregate real per capita incomes are higher in Table 5 than in the corresponding row entry in Table 1. Rental incomes are lower, however, as the net outmigration has reduced the labour to land ratio in the East. Thus while the region as a whole adjusts to the oil price shock and western province-

building efforts rather well, owners of fixed assets will still see the accommodation as damaging to their interests. If, as suggested in earlier work (Norrie and Percy, 1982) these are disproportionately influential groups, the process will take on decidedly regional political overtones.

It is instructive to recall at this stage that there are two separate types of distortions due to government policy with respect to the distribution of resource revenue under investigation. The first, exemplified in Tables 1 - 4, stems from underpricing publicly provided private output. This distortion leads to reallocations in both input and output markets, and the costs which emerge are equivalent to those which would arise from tariff protection, i.e., a wedge between private and social costs and benefits. These simulations also incorporates an element of fiscally induced migration to the extent that the fall in the cost of living index induces greater migration to the region in the longer run.

The simulation results provided in Tables 5 and 6 model the inter-regional consequences of pure fiscally induced migration in addition. The distribution of the social dividend in the resource abundant region leads labour to allocate itself between regions until real incomes inclusive of net fiscal benefits are equalized. This migration further distorts the allocation of resources, as the marginal product of labour in the resource abundant region must decline by enough to offset its net fiscal benefit. The nominal price of labour is thus lower than it would otherwise be and all sectors expand more than before, especially those which are labour intensive or face highly elastic external supplies or demands. On balance, the evidence seems to suggest that the efficiency costs associated with pure rent-seeking migration exceed those due to underpricing regional public goods, at least for the parameter values used in these simulations. National real income is sub-

stantially lower in Table 5 than in either Table 1 or 2. One would need further experimentation with alternative elasticities, however, to establish this point more generally.[4]

The governments of the resource-rich provinces allocate the economic rent they receive from resource production in both ways. Some of the revenue is tied to the provision of specific types of output through offering it to the voter at a lower apparent tax price or charge per unit (subsidizing education for example, which lowers property taxes). This induces consumers to substitute public for private sector output, and leads to the crowding out phenomenon seen in Tables 1 - 4. The remainder of the revenue is returned to residents by reducing the general levy for a given volume of government expenditures (a lower personal income tax rate than would be otherwise possible for example), and thus is equivalent to a pure fiscal transfer of the type illustrated in Tables 5 and 6. The second of these causes interregional distortions in resource allocation, while the first adds an internal dislocation to this.

Thus far we have not discussed in much detail the joint impact of the terms of trade adjustment and provincial rent distribution schemes on rents to region specific factors. There are two sources of those rents leaving aside the energy sector. The first is the regional total of producers surplus which arises from the assumption of decreasing returns to scale in production by all sectors. The second source is the rent of land used in the renewable resource and service sectors of both regions. Table 7 provides estimates of the real value of these rents measured relative to the base of Table 1 prior to the doubling of oil prices and subsequent interregional adjust-

ment. These rent estimates are not expressed in per capita terms as we assume that their pre-oil shock distribution is maintained even after the shock in both regions.

TABLE 7

Real value of Economic Profits and Land Rents by Region After the Doubling of Oil Prices and Inter-regional Labour Flows

	East[1]	West[1]	East[2]	West[2]	East[3]	West[3]
	(1)	(2)	(3)	(4)	(5)	(6)
Economic Profits	96.6	97.5	95.4	97.8	92.7	105.4
Land Rents	96.7	97.8	95.4	97.6	91.7	103.5

(100 = Pre-oil Shock Initial Position of Table 1)

1) Derived from simulations underlying Table 1

2) Derived from simulations underlying Table 3

3) Derived from simulations underlying Table 5

It is these region specific factors especially those in the declining region which bear the brunt of the interregional adjustment. The region specific rents of the East decline in response to the regions deterioration in its terms of trade but the extent of the decline also depends importantly on the nature of the province-building strategies pursued in the West. The scenario (Table 5) where the West allocates rent through the provision of government sector output and distributes a fiscal dividend without a length of residency requirement represents the worst case from the prospective of owners of immobile factors in the East. This latter group which consist of

landowners, local merchants, developers, and other real property interests also tends to be disproportionately active politically. Thus 'Eastern' hostility to the terms of trade adjustment to higher energy prices is inevitable given the resulting income distribution consequences. But some of the East's concern, however, may be justified to the extent that the adjustment process is affected by Western province-building strageties.

The impact of the terms of trade shift and concomitant province-building strategies on returns to region specific factors in the West is somewhat surprising. The relative levels of real land rents and economic profits provided in Table 7, decline in column (2), decline slightly less in column (4), and rise in column (6). The decline in land rents in the first two scenarios occurs because the fall in output of the renewable resource sector more than offsets the impact on demand for land which occurs because of the expansion of the service sector. Only in scenario 3 is the increase in the demand for land from expansion of the service sector sufficient to offset the decline arising from contraction of the renewable resources sector. If we had made land in the service sector a specific input urban lands would have risen significantly in all scenarios. Conversely a sector specific land input in the renewable resources sector would have led to significant declines in agricultural land rents in all scenarios. The decline in rent economic profits evident in scenarios (1) and (2) arises from two sources. First, the terms of trade shift does lead to greater specialization in the regional economy and the contraction of traditional exporting sectors. Consequently, total regional producers surplus from these sectors declines. Second, the absolute and relative expansion of the government sector leads to crowding out of other sectors and a further decline in producers surplus. Again only in scenario (3) which incorporates a significant element of pure fiscally induced migration

and displays a significant degree of industrial diversification is there an increase in the real value of economic profits. The crowding out phenomenon evident in the first two scenarios perhaps is one reason why business interests display such hostility in the West to the distribution of rents through the provision of government sector output. The potential gains in rents from the larger extensive growth of the economy are offset by crowding out from expansion of the government sector. Province-building strategies embodying a large degree pure fiscal incentive would from the perspective of business interests in the West yield the largest regional income gains.

Conclusion

In this paper we have examined the process of interregional adjustment to a shift in the regional terms of trade under various assumptions regarding the distribution of economic rents and degree of interregional labour mobility. Our procedure was to specify a highly stylized model of the Canadian economy which consisted of two multi-sector regions. An energy-rich West and an industrialized East. This approach differs from that we adopted earlier (Norrie and Percy, 1983 & 1982) where we had specified a one region model and employed a 'rate of change' format to analyze the impact of rising energy prices and different mechanisms to distribute rent.

The model was then shocked with a doubling of energy prices for three separate scenarios for the distribution of economic rents. The use of these rents by governments to promote extensive growth and industrial diversification are assumed by us to represent the economic underpinnings of province-building strategies.

Our results indicate that 'westward shift' is an inevitable result of

the adjustment to higher energy prices but that the nature of the adjustment is sensitive to the manner in which provincial government distribute energy rents. Aggregate real income and real income per capita decline in the East and rise in the West. The magnitude of the extensive and intensive growth of the West depends critically on the manner in which the rents are distributed in the region. Increasing the share of rents going to finance the provision of government sector output (scenario 2) or a combination of the latter plus a fiscal dividend distributed to residents without a length of residence requirement (scenario 3) lead to greater extensive growth but at the expense of intensive growth. Under the last scenario real income per capita is in fact lower than it was in the pre-oil shock base case.

The impact of the terms of trade adjustment under alternate rent distribution schemes using this approach is consistent with what we have offered elsewhere. The improvement in the West's terms of trade does lead to increased regional specialization. Import-competing goods manufacturing and traditional export sectors tend to contract absolutely while non-trade sectors expand. This tendency for greater specialization can be offset by government policies but only at the expense of lower levels of real income per capita. It is the West which bears the brunt of province-building strategies; the costs are not exported to other jurisdictions except in the case of region specific factors whose returns are sensitive to population levels. It is the terms of trade shock, however, rather than the province-building strategies pursued in the West which is mainly responsible for any decline in aggregate real returns to regional specific capital in the declining region. The small size of the West compared to the East and the mobility of labour ensures that real wage declines in the East caused by the terms of trade shift are also borne by labour in the West.

Why then, finally, would provincial governments in resource abundant 'province-building' policies if they actually cause real incomes per capital to fall? If extensive economic growth is viewed as desirable in and of itself, as it typically is by regional policy makers, the strategy is remarkably successful. The answer also probably lies in part in the distributional patterns discussed above. Some groups gain unambiguously as a result of the strategies, and none lose absolutely. There is less economic rent per capita available than there would be otherwise, but this redistribution is not made in any event. In other words, this system is decidedly inferior to one where the government collected all the economic rents and distributed them to those residents in the region prior to the boom (McMillan and Norrie, 1980). But since this is not a viable policy option, there are no apparent disadvantages to the present option. Pre-boom residents do not benefit to the extent they could, which is less of an incentive to political action than if they were actually made worse off.

FOOTNOTES

1) The parameter B could be specicified to include, for example, agglomeration economies which come into existence when the region's population reaches some threshold population.

2) This is the specification suggested by Whalley and Yeung (1980).

3) The lump-sum transfer we have modeled generates distortions only when interregional migration is permitted. Even these distortions could be prevented by specifying that those residents of the West at a given point in time in the past would be eligible for the grants.

4) We have found that the simulation results are very sensitive to the specification of the price elasticities of demand for government output. The simulation results of Table 1, 3 and 5 all incorporate a price elasticity of demand of -.09 for government sector output. An increase in the absolute value of this elasticity to -.90 causes a much greater expansion of the government sector in the West in response to the terms of trade shift and even larger declines in real income than those suggested in Tables 1, 3 and 5.

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